

REMARKS

The following remarks are provided in response to the Office action mailed April 24, 2007 in which the Examiner:

- rejected claims 18, 19 and 23-32 under 35 U.S.C. §103(a) as being unpatentable over KR 2001055915 to Yang (hereinafter Yang) in view of EP 0843348 to Xia et al. (hereinafter Xia).
- rejected claims 14-17 under 35 U.S.C. §103(a) as being unpatentable over Yang in view of Xia and further in view of EP 1139403 to Germann et al. (hereinafter Germann).

The Applicants respectfully request reconsideration of the above referenced patent application for the following reasons:

Claims 18, 19 and 23-32 rejection under 35 U.S.C. §103(a)

The Examiner rejected claims 18, 19 and 23-32 under 35 U.S.C. §103(a) as being unpatentable over Yang in view of Xia. The Applicants herein cancel claims 24-32 without prejudice. The Applicants herein amend independent claim 18, upon which claims 19 and 23 depend, and respectfully request reconsideration of claims 18, 19 and 23 in view of the amendments and the following arguments.

In claims 18, 19 and 23, the Applicants teach and claim a method to control nitride consumption during integrated circuit manufacture. The method comprises first placing a substrate having a nitride layer in a reaction chamber. A silicon source, an oxygen source, a boron source and a phosphorous source are then provided. The silicon,

oxygen and boron sources are injected into the reaction chamber while injection of the phosphorous source in the reaction chamber is delayed for a predetermined period of time. This delay enables first deposition of a boron-rich silicate glass film over the nitride layer. Next, a predetermined amount of the phosphorous source is injected into the reaction chamber following the predetermined period of time. Meanwhile, injection of the silicon, oxygen and boron sources into the reaction chamber is continued in order to deposit a borophosphosilicate film over the boron-rich silicate glass film. The borophosphosilicate glass layer comprises approximately 2-9 weight percent of phosphorous. Finally, the borophosphosilicate glass layer is annealed to consume at least a portion of the nitride layer. The predetermined period of time for delaying injecting the phosphorous source and the predetermined amount of the phosphorous source are selected relative to the desired nitride layer consumption. That is, **the Applicants teach and claim a method comprising selecting the delay time and amount of a phosphorous source relative to a desired amount of nitride layer consumption.**

The Examiner relies on Yang to disclose depositing a BSG film on a silicon nitride layer and then depositing a film of BPSG on the BSG layer (Office Action dated April 24, 2007; page 5, second paragraph). Yang fails to disclose a method comprising targeting consumption of at least a portion of a nitride layer underneath a BSG layer. In fact, Yang teaches away from targeting consumption of at least a portion of a nitride layer because Yang discloses preventing the nitride layer from being etched altogether by the BPSG layer (*see* Patent Viewer translated version of Yang). Thus, **Yang discloses**

preventing altogether the etching of a nitride layer, whereas the Applicants teach and claim targeting consumption of at least a portion of a nitride layer.

The Examiner relies on Xia to disclose using silicon, oxygen, and boron sources to form a BSG layer and using silicon, oxygen, boron and phosphorous sources to form a BPSG layer (Office Action dated April 24, 2007; page 5, fourth paragraph). Thus neither Yang nor Xia, alone or in combination, disclose a method comprising selecting the delay time and amount of a phosphorous source relative to a desired amount of nitride layer consumption, as taught and claimed by the Applicants.

Claims 14-17 rejection under 35 U.S.C. §103(a)

The Examiner rejected claims 14-17 under 35 U.S.C. §103(a) as being unpatentable over Yang in view of Xia and further in view of Germann. The Applicants herein amend independent claim 14, from which claims 15-17 depend, and respectfully request reconsideration of claims 14-17 in view of the amendments and the following arguments.

In claims 14-17, the Applicants teach and claim a method of forming an insulating film on a substrate to reduce nitride consumption during manufacture. The method comprises placing a substrate having a nitride layer thereon in a reaction chamber. A silicon source, an oxygen source, a boron source and a phosphorous source are then provided for chemical vapor depositing a doped silicate glass layer over the nitride layer. Prior to mixing any of the flows of the silicon, oxygen, boron or phosphorous sources, the flows are individually stabilized. The silicon source, the oxygen source and the boron

source are then injected into the chamber for a predetermined period of time to form a borosilicate glass layer over the nitride layer on the substrate. Finally, the phosphorous source is injected into the chamber while injection of the silicon, oxygen and boron sources into the chamber is continued in order to deposit a borophosphosilicate glass layer over the borosilicate glass layer. That is, **the Applicants teach and claim a method comprising individually stabilizing the flows of the silicon, oxygen, boron and phosphorous sources prior to mixing.**

The Examiner relies on Germann to disclose delaying introduction of the source gases into the chamber until their flows stabilize (Office Action dated April 24, 2007; page 8, final paragraph). However, Germann fails to disclose a method comprising individually stabilizing source flows prior to mixing the source flows. Germann does disclose bypassing a reactor with a mixture of gases until the mixture of gases stabilizes (*see* abstract, paragraph [0009]). Furthermore, Germann discloses mixing the gases before introduction into a process chamber (*see e.g.* Figure 3, where only a single gas inlet is shown). Nonetheless, Germann is silent with respect to stabilizing individual source gases prior to their introduction into a reaction chamber, as taught and claimed by the applicants. Thus, **Germann discloses stabilizing a mixture of gases**, whereas **the Applicants teach and claim individually stabilizing each source flow prior to mixing the source flows.**

The Examiner argues that if the gas mixture of Germann is stabilized, then each of the individual gases of the mixture must necessarily be stabilized (Office Action dated April 24, 2007; page 8, final paragraph). However, the Applicants respectfully point out

that it is well known in the art that a mixture of gases does not necessarily exhibit the combined properties of each individual gas. Thus, the conditions used to stabilize a gas mixture are not the same as the conditions required to stabilize each individual gas. That is, merely because a mixture of gases is stabilized does not mean that the individual gases would be stabilized under the same conditions, as argued by the Examiner. In claims 14-17, the Applicants teach and claim a method of first delaying the introduction of the phosphorous source gas while the other source gases are introduced into a reaction chamber. The phosphorous source gas is then introduced into the chamber following a predetermined amount of time. Accordingly, the phosphorous gas requires stabilization individually and not as a component of a mixture, as taught and claimed by the Applicants.

The Examiner relies on Yang to disclose depositing a BSG film and then depositing a film of BPSG on the BSG layer (Office Action dated April 24, 2007; page 5, second paragraph). The Examiner relies on Xia to disclose using silicon, oxygen, and boron sources to form a BSG layer and using silicon, oxygen, boron and phosphorous sources to form a BPSG layer (Office Action dated April 24, 2007; page 5, second paragraph). Thus none of Germann, Yang nor Xia, alone or in combination, disclose a method comprising individually stabilizing the flows of the silicon, oxygen, boron and phosphorous sources prior to mixing, as taught and claimed by the Applicants.

CONCLUSION

The Applicants submit that they have overcome the Examiner's claim rejections and that they have the right to claim the invention as set forth in the listed claims. The Examiner is respectfully requested to contact the undersigned by telephone if it is believed that such contact would further the examination of the present application.

Pursuant to 37 C.F.R. 1.136(a)(3), Applicant(s) hereby request and authorize the U.S. Patent and Trademark Office to (1) treat any concurrent or future reply that requires a petition for extension of time as incorporating a petition for extension of time for the appropriate length of time and (2) charge all required fees, including extension of time fees and fees under 37 C.F.R. 1.16 and 1.17, to Deposit Account No. 02-2666.

Respectfully submitted,

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Dated

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